Customer No.: 31561
Docket No.: 10547-US-PA
Application No.: 10/710,020

REMARKS

Present Status of the Application

Claims 1-10 are rejected under 35 U.S.C. 103(a) as be unpatentable over Bojkov et al. (U. S. Pub. 2004/0140219; hereinafter Bojkov) in view of Chung et al. (U. S. Patent 6,409,903; hereinafter Chung) and Jao (U. S. Patent 6,415,974). Applicants have assed claim 11. Claims 1-11 remain pending in the present application, and reconsideration of those claims is respectfully requested.

Discussion of Claim Rejections under 35 USC 103

Claims 1-10 are rejected under 35 U.S.C. 103(a) as be unpatentable over Bojkov in view of Chung and Jao. Applicants respectfully traverse the rejections for at least the reasons set forth below.

1. The present invention is directed to form the bumps by the electroplating process. Independent claim 1 recites the features as follows:

> A process for fabricating bumps, comprising the steps of:
>
> providing a wafer having a plurality of bonding pads and a passivation layer thereon, wherein the passivation layer is disposed on a surface of the wafer and exposes the bonding pads;
>
> forming a photoresist layer over the wafer, wherein the photoresist layer has ***a plurality of openings with different widths*** and the openings are positioned corresponding to the bonding pads;
>
> immersing the wafer into an electrolytic solution; and

performing an electroplating operation by providing an increasing step current to the electrolytic solution (*Emphasis added*).

Since the ***electroplating operation*** is taken, the ***openings with different widths*** may cause the problem as discussed in specification at paragraphs [0008]-[0009]. Particularly, when the aspect ratio is greater then 1.2, the problem does apparently exist.

The present invention then proposes the operation current is applied by an increasing step current, as for example shown in FIGs. 3A-3B and FIGs. 4A-4C.

2. In re Bojkov, as for example shown in FIG. 2A, the opening of the layer 46 with different width is not considered. Further, FIGs. 4A - 4C disclose the electrical current 120 and 122 with the same level while the relaxing period 124 is between adjacent two step currents ([0040]). *Apparently, Bojkov fails to disclose the increasing step current for the opening with different width.*

3. In re Chung, as described by Chung (col. 7, lines 14-17), Chung is to avoid the detrimental burn-through of the seed layer 23 of the wafer 22 in Figs. 1 and Fig. 2.

In other words, Chung is involved in the conventional issue of electroplating operation (burn-through of the seed layer). There is even no any opening being disclosed. In other words, Chung never considers the electroplating problem due to high aspect ratio of opening while plating bumps in the openings with different widths.

Therefore, Chung does not specifically provide the motivation to modify Bojkov into the present invention.

4. In re Jao, Jao is cited by the Office Action to provide the different opening width. However, Jao has proposed the different mechanism by adjusting the area of the UBM 204 (col. 4, lines 31-32; FIG. 2A), and the main purpose of Jao's invention is to improve the coplanarity of the solder bumps structure either using the various sizes of openings of the UBM layer to control the solder volume or using the various UBM structures to control the height of the solder bumps, or using a combination thereof (col. 5 lines 43-47). Even through Jao teaches a method of forming bumps having a plurality of openings with various sizes, there is no issue of current control, burn-through or aspect ratio of the openings being disclosed. In other words, Jao never considers current control and aspect ratio of the openings in the electroplating process. There is no motivation to modify Bojkov and Chung into Jao.

Alternatively, Jao in Figs. 3A-3B discloses that the widths of openings 330a and 330b are adjusted for obtaining the same height of the solder.

However, it should be noted that the aspect ratios of the openings 330a and 330b are significantly less than 1. In this situation of the small aspect ratio, the problem of "mass transfer of electrolytic solution" as addressed in paragraph [0008] of the specification basically does not exist. Jao discloses the electroplating operation in different issue and in different mechanism for solution.

5. The present invention is more effective for the higher aspect ratio, such as the aspect ratio is greater then 1.2 as recited in newly added claim 11, which is at least supported by the specification at paragraphs [0008]-[0009].

6. In conclusions, Bojkov, Chung and Jao either alone or in combination does not disclose the present invention, in which the considering issues and its solution are also different from the present invention.

For at least the foregoing reasons, Applicants respectfully submit that independent claim 1 patently defines over the prior art references, and should be allowed. For at least the same reasons, dependent claims 2-10 patently define over the prior art references as well. Claim 11 further distinguish over the prior art references.

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CONCLUSION

For at least the foregoing reasons, it is believed that all the pending claims 1-11 of the invention patently define over the prior art and are in proper condition for allowance. If the Examiner believes that a telephone conference would expedite the examination of the above-identified patent application, the Examiner is invited to call the undersigned.

Respectfully submitted,

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